959,472

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Plasma Jet Torches

I, HER MAJESTY'S PRINCIPAL SECRETARY OF STATE FOR THE WAR DEPARTMENT, LONDON, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to plasma jet torches and is particularly concerned with spray torches using plasma jets for heating the material to be sprayed.

The invention comprises a spray torch including a plurality of nozzles and means for producing a plasma jet from each nozzle, the arrangement being such that the jets converge forward of the nozzles to form a combined jet, means also being provided for feeding, from the rear into the combined jet, a material to be sprayed.

The nozzles may be each associated with a separate plasma jet torch or may be arranged to emit separate jets from a single torch. Preferably at least three nozzles are used and these are arranged symmetrically about a central axis which is also the axis of the combined jet.

A further nozzle may be included coaxial with the combined jet, at, or near, the point of convergence of the individual jets. This further nozzle would assist in smoothing out any turbulence which may be present in the combined jet as a result of the impingement of the individual jets. This nozzle, by being connected electrically to the negative electrodes through a power source, can be used to increase the plasma energy.

The material to be sprayed may be either a rod or powder compacted into rod form. Alternatively, a powder or a mixture of powders from one or more containers, may be fed into the combined jet in a stream of gas or liquid.

One arrangement, in accordance with the invention, will now be more particularly described, by way of example only, with reference to the accompanying diagrammatic drawings in which:—

Fig. 1 is a view rearwardly along the axis of the combined jet and

Fig. 2 is a section on the line II—II of Fig. 1.

Four similar plasma jet torches which may be of known design and whose nozzle ends only are shown in the drawings are arranged with the axes 3 of their nozzles 1 equi-spaced on the surface of a hypothetical cone so that the four jets will converge at the apex 2 of the cone. Alternatively, the nozzle axes 3 may be at a slight angle to the generators of the cone, to produce a tangential component with the object of inducing a swirling motion into the plasma stream. The nozzle end of each torch is shown in Fig. 2 as comprising a nozzle 1 and a central electrode member 8, both water cooled and separated by an insulating ring 9. A fifth nozzle 4, coaxial with the cone, extends forwardly from its apex 2 to smooth the flow of the combined jet. Rearward of the fifth nozzle 4 is provided a rod feed mechanism 7 for feeding a rod 5, or rod shaped compact, along the axis 6 of the cone into the combined jet. This feed mechanism could be replaced, if desired, by an axially disposed nozzle or a group of nozzles around the axis 6 of the cone for feeding a powder, in a gaseous or liquid carrier, into the jet.

More or less than four torches may be used, if desired, the axes of their nozzles being either equi-spaced on the surface of a single cone or arranged in symmetrical groups on the surfaces of two or more coaxial cones of different apex angle. If only a few jets are used in conjunction with a rod feed of comparatively large diameter a further improvement in uniformity of heating may be obtained by rotating the rod 5 as it is fed forward.

An arrangement such as has been described produces more uniform heating of the mate-

rial to be sprayed than would be the case were the material fed radially into a single jet or even through a tubular electrode into the arc of a single jet torch. In the latter case the arc might well be struck on one side of the tubular electrode only and hence, preferentially heat one side of the material, or it could move round the electrode in an irregular manner to cause uneven heating of the material. The more uniform heating would, of course, result in an improved product.

WHAT I CLAIM IS:—

1. A spray torch including a plurality of nozzles and means for producing a plasma jet from each nozzle, the nozzles being so arranged that the jets converge forward thereof to form a combined jet; means also being provided for feeding, from the rear into the combined jet, a material to be sprayed.

2. A spray torch as claimed in Claim 1 wherein the nozzles are disposed symmetrically about a central axis which is also the axis of the combined jet.

3. A spray torch as claimed in either Claim 1 or Claim 2 wherein each nozzle is associated with a separate plasma jet torch.

4. A spray torch as claimed in any one of Claims 1 to 3 wherein is provided an additional nozzle at or near the convergence of the individual jets and coaxial with the combined jet for smoothing the flow of the combined jet.

5. A spray torch as claimed in Claim 4 wherein the additional nozzle is maintained at a negative potential with respect to the anode or anodes of the plasma generating means to increase the energy of the plasma.

6. A spray torch as claimed in any one of Claims 1 to 5 having a rod feed mechanism for feeding a rod or rod shaped compact from the rear into the combined jet.

7. A spray torch as claimed in Claim 6 having means for rotating the rod or compact about its axis as it is fed into the jet.

8. A spray torch as claimed in any one of Claims 1 to 5 having at least one nozzle rearward of the combined jet for feeding powder thereto.

9. A spray torch as claimed in any one of Claims 1 to 8 wherein the nozzles are so inclined as to impart a small tangential component to the direction of the individual jets whereby a rotary movement is applied to the combined jet.

10. A spray torch constructed, arranged, and adapted to operate substantially as hereinbefore described.

11. A spray torch constructed, arranged, and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

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1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

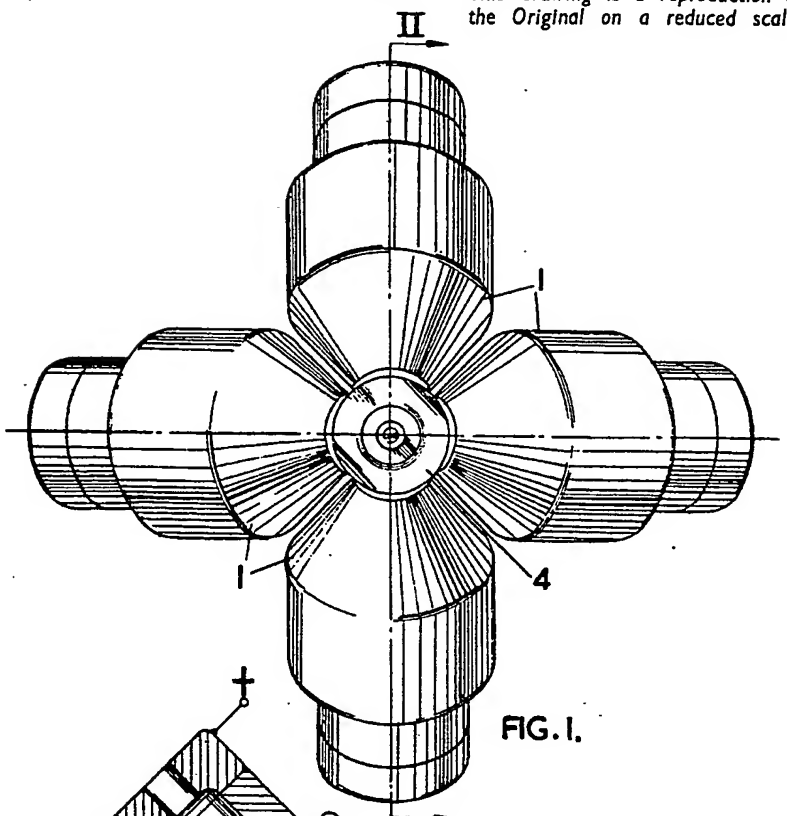

FIG. 1.

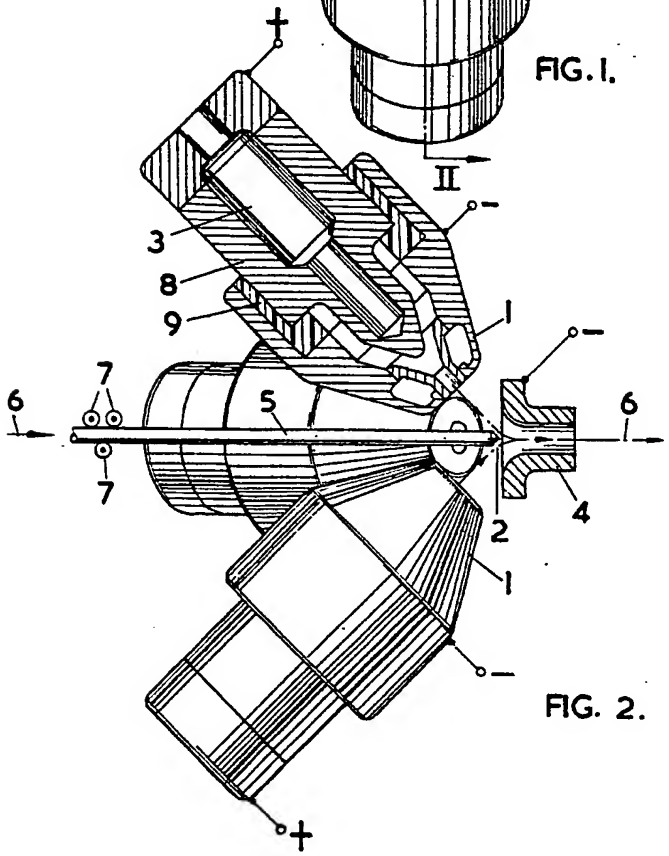

FIG. 2.